

STARPOWER

SEMICONDUCTOR

MOSFET

MD300HFC120C2S

1200V/300A 2 in one-package

General Description

STARPOWER MOSFET Power Module provides very low $R_{DS(on)}$ as well as optimized intrinsic diode. It's designed for the applications such SMPS and DC drives.

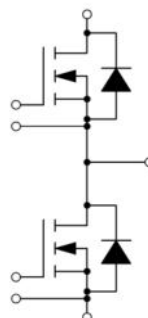
Features

- SiC power MOSFET
- Low $R_{DS(on)}$
- Optimized intrinsic reverse diode
- Chip sintering technology
- Low inductance case avoid oscillations
- Isolated copper baseplate using AlN DBC technology

Typical Applications

- Main and auxiliary AC drives of electric vehicles
- DC servo and robot drives
- Battery vehicles
- UPS equipment
- Plasma cutting

Equivalent Circuit Schematic



Absolute Maximum Ratings

MOSFET

Symbol	Description	Value	Unit
V_{DSS}	Drain-Source Voltage	1200	V
V_{GSSmax}	Gate-Source Voltage	-8/+19	V
V_{GSSop}	Gate-Source Voltage	-4/+15	V
I_D	Drain Current @ $T_C=25^{\circ}C$ @ $T_C=90^{\circ}C$	409 300	A
I_{DM}	Pulsed Drain Current	720	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}C$	1724	W

Body Diode

Symbol	Description	Value	Unit
I_S	Source Current @ $T_C=100^{\circ}C$	TBD	A
I_{SM}	Pulsed Source Current	720	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	$^{\circ}C$
T_{jop}	Operating Junction Temperature	-40 to +150	$^{\circ}C$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}C$
V_{ISO}	Isolation Voltage RMS, $f=50Hz, t=1min$	2500	V

MOSFET Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$R_{DS(on)}$	Static Drain-Source On-Resistance	$I_D=240A, V_{GS}=15V, T_j=25^{\circ}C$		5.33	6.93	$m\Omega$
		$I_D=240A, V_{GS}=15V, T_j=175^{\circ}C$		9.60		
$V_{GS(th)}$	Gate-Source Threshold Voltage	$I_D=69mA, V_{DS}=V_{GS}, T_j=25^{\circ}C$	1.8	2.5	3.6	V
g_{fs}	Forward Transconductance	$V_{DS}=20V, I_D=240A$		162		S
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=V_{DSS}, V_{GS}=0V, T_j=25^{\circ}C$			114	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=V_{GSS}, V_{DS}=0V, T_j=25^{\circ}C$			1500	nA
R_{Gint}	Internal Gate Resistance			0.70		Ω
C_{iss}	Input Capacitance	$V_{GS}=0V, V_{DS}=1000V, f=100kHz$		20.1		nF
C_{oss}	Output Capacitance			0.77		nF
C_{rss}	Reverse Transfer Capacitance			48		pF
Q_g	Total Gate Charge	$I_D=240A, V_{DS}=800V, V_{GS}=-4/+15V$		708		nC
Q_{gs}	Gate-Source Charge			240		nC
Q_{gd}	Gate-Drain ("Miller") Charge			204		nC
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=600V, I_D=300A, R_G=3.0\Omega, V_{GS}=-4/15V, T_j=25^{\circ}C$		85		ns
t_r	Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			148		ns
t_f	Fall Time			27		ns
E_{on}	Turn-On Switching Loss			7.67		mJ
E_{off}	Turn-Off Switching Loss			5.13		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=600V, I_D=300A, R_G=3.0\Omega, V_{GS}=-4/15V, T_j=125^{\circ}C$		89		ns
t_r	Rise Time			44		ns
$t_{d(off)}$	Turn-Off Delay Time			174		ns
t_f	Fall Time			29		ns
E_{on}	Turn-On Switching Loss			4.59		mJ
E_{off}	Turn-Off Switching Loss			7.87		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=600V, I_D=300A, R_G=3.0\Omega, V_{GS}=-4/15V, T_j=150^{\circ}C$		90		ns
t_r	Rise Time			45		ns
$t_{d(off)}$	Turn-Off Delay Time			179		ns
t_f	Fall Time			32		ns
E_{on}	Turn-On Switching Loss			4.46		mJ
E_{off}	Turn-Off Switching Loss			7.69		mJ

Body Diode Characteristics $T_F=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage	$I_S=120\text{A}, V_{GS}=-4\text{V}, T_J=25^{\circ}\text{C}$		4.60		V
		$I_S=120\text{A}, V_{GS}=-4\text{V}, T_J=175^{\circ}\text{C}$		4.00		
t_{rr}	Diode Reverse Recovery Time	$V_R=600\text{V}, I_S=300\text{A}, -di/dt=7830\text{A}/\mu\text{s}, V_{GS}=-4\text{V}, T_J=25^{\circ}\text{C}$		24		ns
Q_r	Recovered Charge			1.0		μC
I_{rrm}	Peak Reverse Recovery Current			64		A
E_{rec}	Reverse Recovery Energy			0.22		mJ
t_{rr}	Diode Reverse Recovery Time	$V_R=600\text{V}, I_S=300\text{A}, -di/dt=6870\text{A}/\mu\text{s}, V_{GS}=-4\text{V}, T_J=125^{\circ}\text{C}$		44		ns
Q_r	Recovered Charge			3.6		μC
I_{rrm}	Peak Reverse Recovery Current			145		A
E_{rec}	Reverse Recovery Energy			1.20		mJ
t_{rr}	Diode Reverse Recovery Time	$V_R=600\text{V}, I_S=300\text{A}, -di/dt=6600\text{A}/\mu\text{s}, V_{GS}=-4\text{V}, T_J=150^{\circ}\text{C}$		47		ns
Q_r	Recovered Charge			4.4		μC
I_{rrm}	Peak Reverse Recovery Current			165		A
E_{rec}	Reverse Recovery Energy			1.75		mJ

Module Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case(Mosfet)			0.087	K/W
R_{thCH}	Case-to-Heatsink (Mosfet)		0.020		K/W
	Case-to-Heatsink (per Module)		0.010		
M	Terminal Connection Torque, Screw M6	2.5		5.0	N.m
	Mounting Torque, Screw M6	3.0		5.0	
G	Weight of Module		300		g

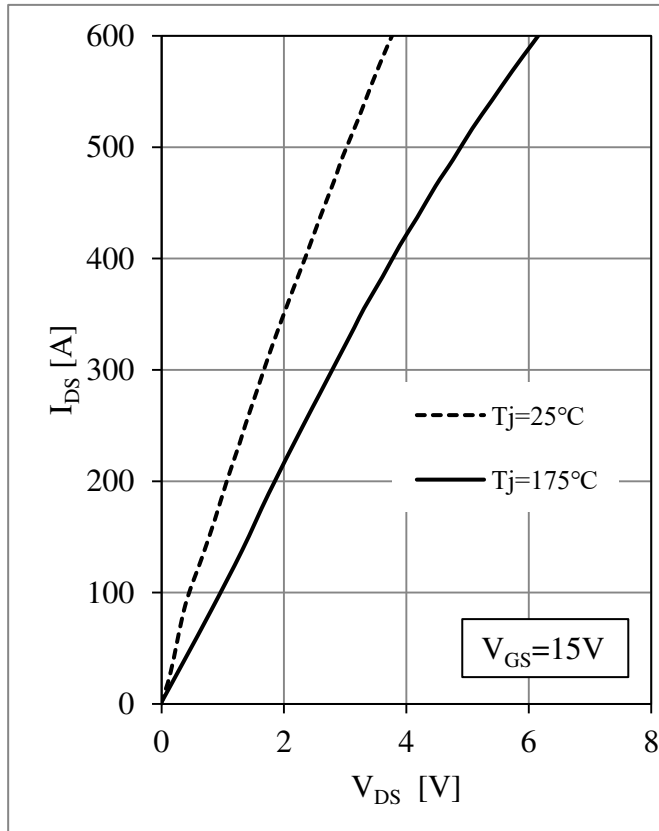


Fig 1. MOSFET Output Characteristics

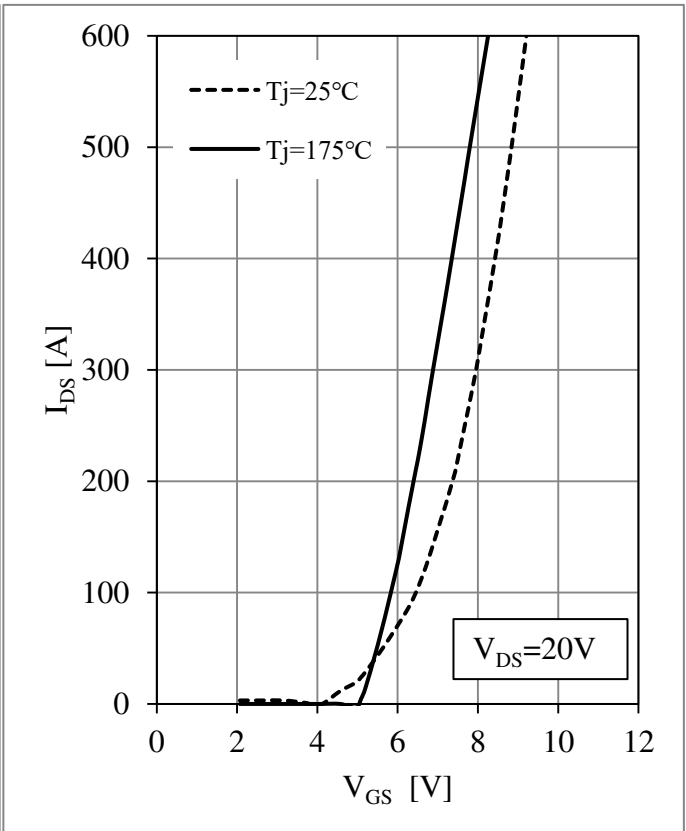
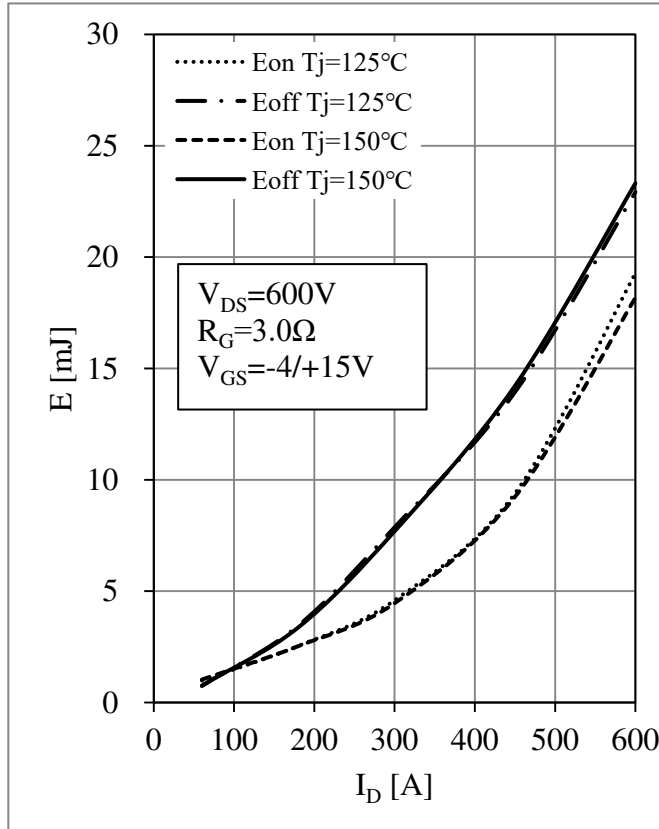
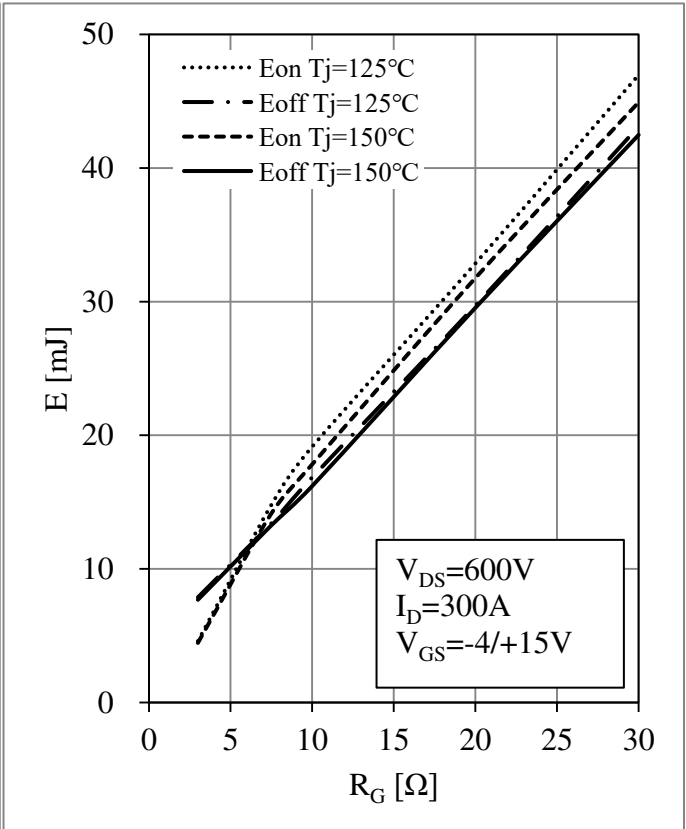


Fig 2. MOSFET Transfer Characteristics

Fig 3. MOSFET Switching Loss vs. I_{DS} Fig 4. MOSFET Switching Loss vs. R_G

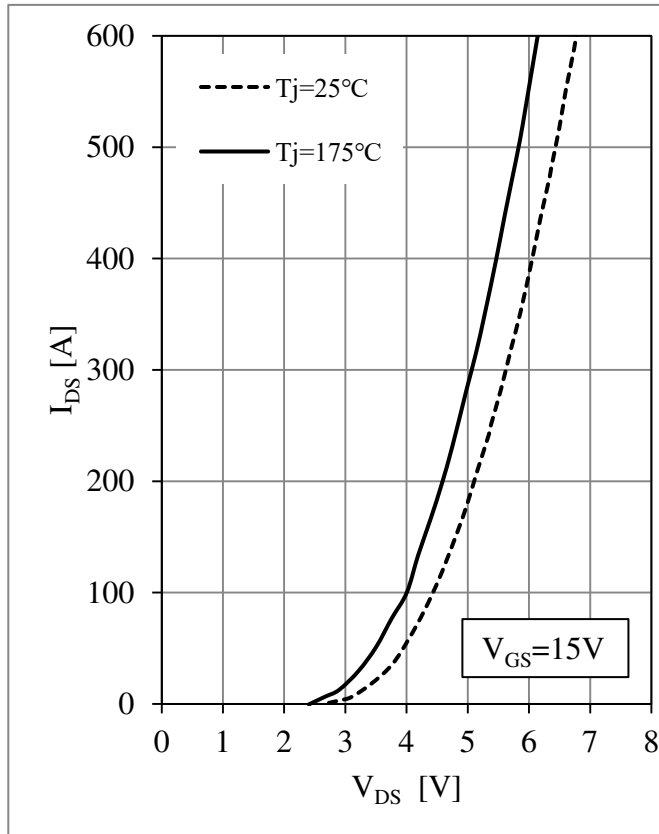


Fig 5. Body Diode Characteristics

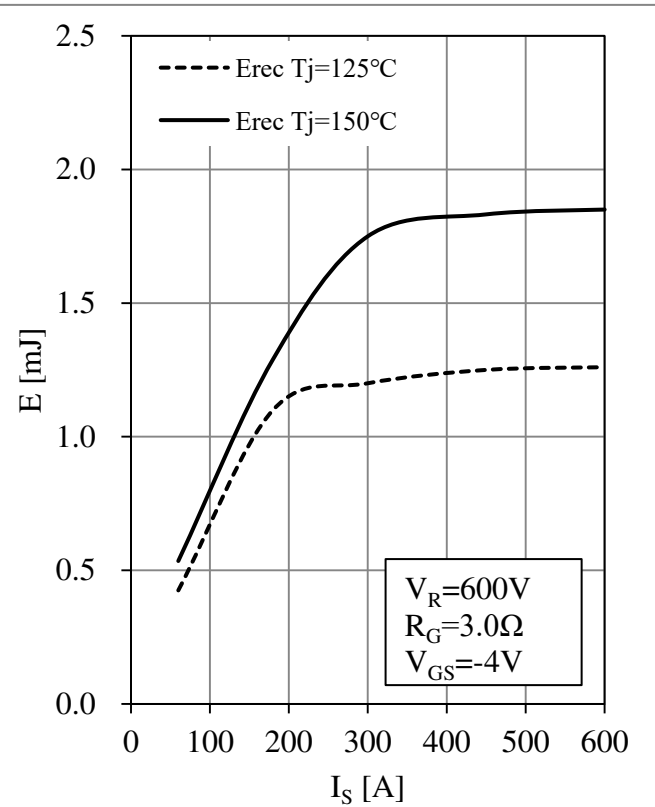
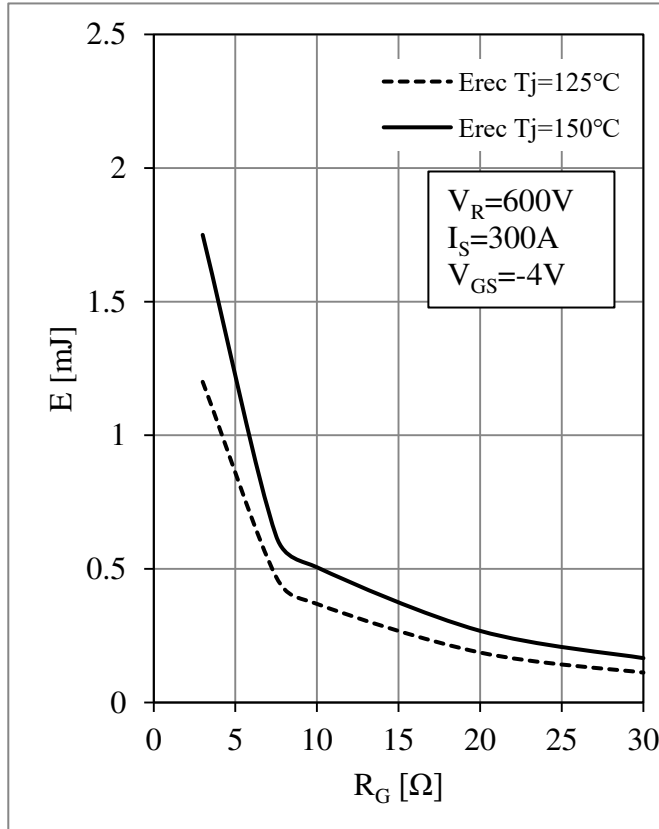
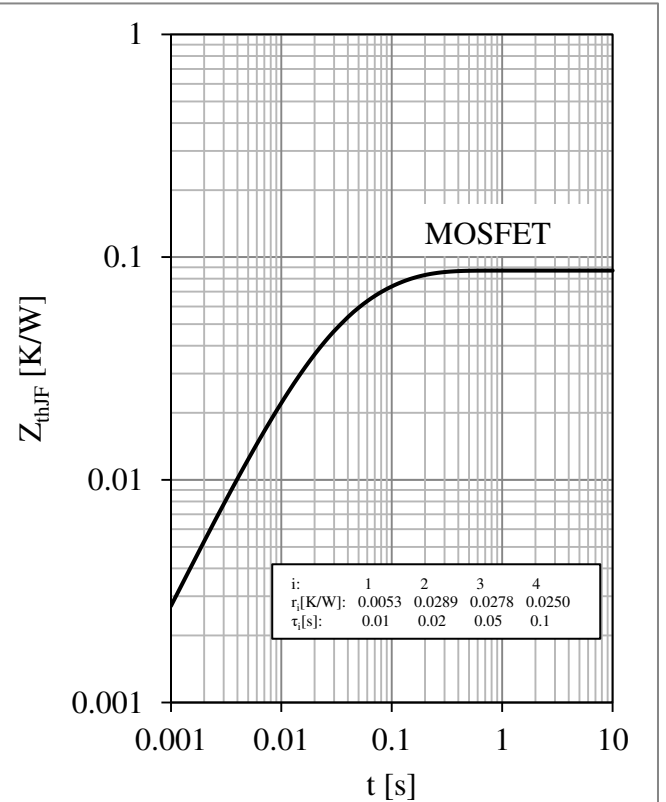
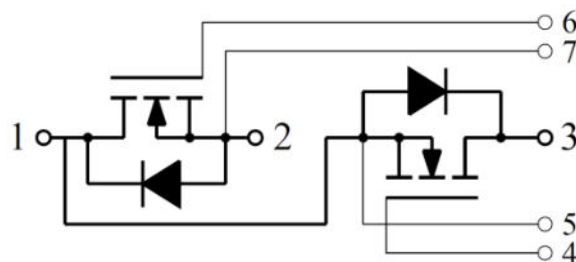
Fig 6. Body Diode Switching Loss vs. I_S Fig 7. Body Diode Switching Loss vs. R_G 

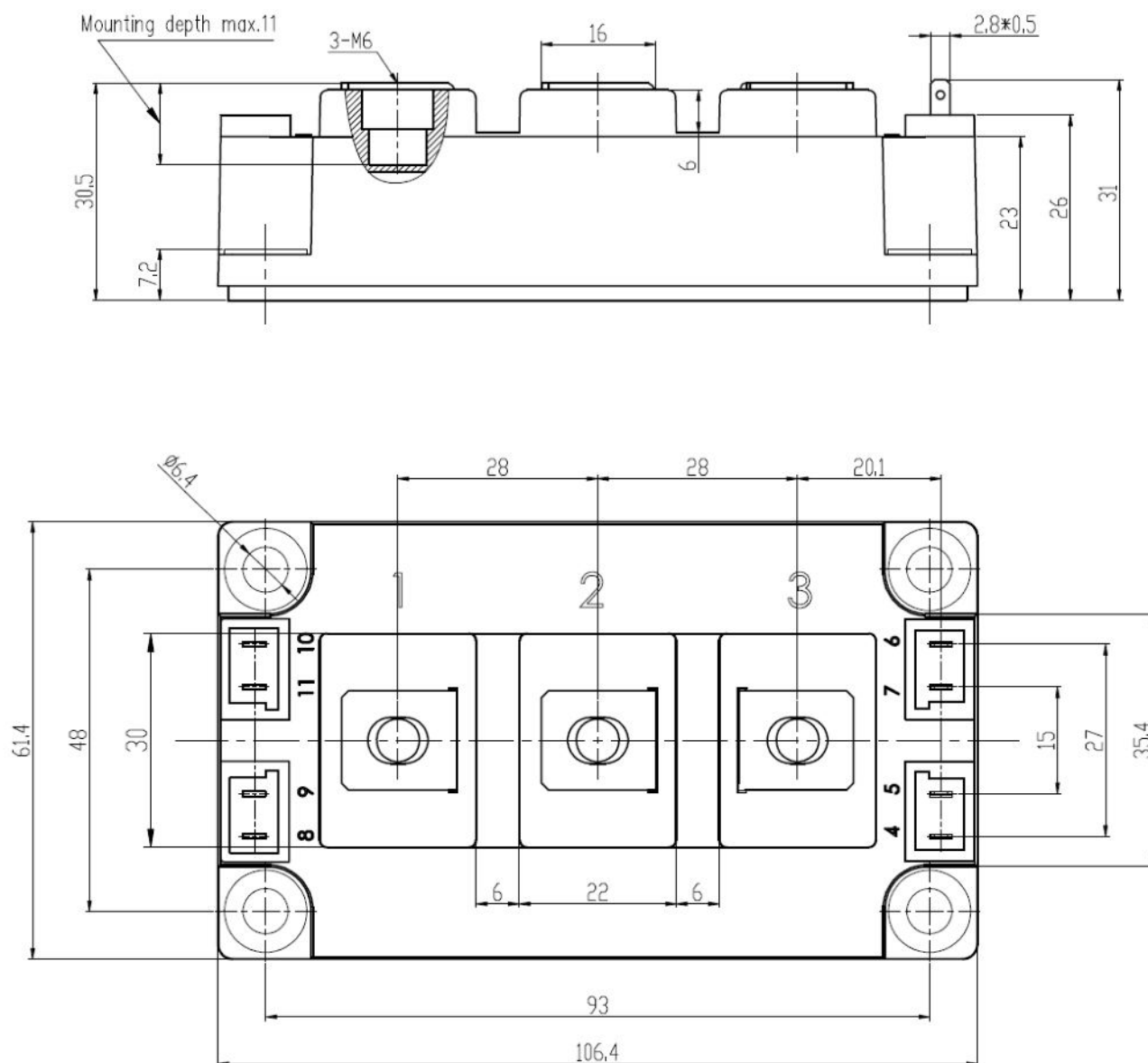
Fig 8. MOSFET Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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